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ABSTRACT

This study assessed the sports nutrition knowledge of current and prospective physical educators/coaches (HPEs) to determine the need for improved education in this area and to compare the nutrition knowledge of HPEs with that of foods and nutrition students (FNSs) and general college students (GENs). A researcher-developed 4-point Likert-type scale, which contained 70 statements, was administered to 58 students representing a cross-section of health and physical education majors enrolled in upper-level major courses, 27 students in 2 upper-level home economics foods and nutritions courses, and a general group comprised of 20 students in non-health/physical education classes. Statements on the scale assessed nutrition supplementation, fluids and hydration, pre-event nutrition, nutrition composition, nutrition terminology, general nutrition, and nutrition opinion. The dependent variable was sports nutrition knowledge. Frequencies and percentages were computed for all items on the scale. Group mean differences were computed and compared by a one-way analysis of variance. The sports nutrition knowledge of HPEs tested is inferior to standard competency levels. Significantly higher means scores for FNSs were found. Education and information sources for HPEs are insufficient. Currently, interscholastic athletic coaches have little direct control over the dietary behaviors of student-athletes. Five tables are included. (RLC)

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Sports Nutrition Knowledge Assessment of Physical Educators and Coaches

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Presented at the Annual Meeting of the Mid-South Educational Research Association, November 11-13, 1992, Knoxville, Tennessee.

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Introduction

For many years the proliferation of literature relating to various aspects of sports nutrition has been growing. In more recent years attention has turned toward finding nutritional behaviors which will produce a "competitive edge" in human performance. Coaches and athletes know that agility, endurance, great reflexes, speed and strength enhance athletes' physical condition. However, the human body needs optimal nutrition to be fully trained for athletic success. Optimal year-around nutrition practices directly influence mental and physical capabilities as a finer point of athletic training. Some daily dietary habits can eliminate nutritional deficiencies which may impede maximal performance potential. Such a diet should commonly consist of adequate caloric intake from six nutrient groups: carbohydrates, fats, proteins, minerals(and electrolytes), vitamins, and water (Clark, 1990).

Some athletes ignore diet, others simply possess unreliable information. Student-athletes seeking nutrition advice deserve physical educator/coaches who can accurately fulfill that responsibility (Parr, Porter & Hodgson, 1984; Pujol & Godsey, 1990). A mentor who owns fact-based knowledge can counsel student-athletes on the importance nutrition has on fueling active persons. It is generally accepted that serious athletes who have knowledge, leading to efficient skills execution and performance, will utilize it when making food/hydration choices (Douglas & Douglas, 1984; Parr et al, 1984; Perron & Endres, 1985).

Some human performance professionals may consider their knowledge-level of ergogenics, biochemistry, bioenergetics, and sports nutrition as sufficient. Yet, studies have shown that physical educators/coaches lack sound knowledge in these areas (Angel, 1988; Bedgood & Tuck, 1983; Cho & Fryer, 1974; Pujol & Godsey, 1990). Familiarity with the recommended elements of coaching certification as jointly posited by the National Association for Girls and Women in Sport, and the National Association for Sport and Physical Education (1987) illustrates the vital nature of this subject.

The purpose of this study was to assess the sports nutrition knowledge of current and prospective physical educator/coaches, to determine the need for improved education in this area. Specifically, the study sought to determine how the nutrition knowledge of prospective physical educator/coaches (HPE) compared with that of foods and nutrition students (FNS), and with that of a general college students (GEN). The following questions were posed prior to the study: 1) What is the knowledge difference between the three groups?; 2) What is the knowledge difference between male and female health/physical education majors?; 3) What are the education and information sources used by each group, and what edifying value do they have?; 4) What opinions do the subjects have related to sports nutrition?; and, 5) What percentage of subjects can meet a 70% mastery standard (Bedgood & Tuck, 1983), and what percentage can meet an 80% standard as set for this investigation?

Method

Sample

In accordance with institutional Human Subjects Research Committee guidelines, a statement of ethical compliance was filed and approved. The research instrument was administered to study participants with informed consent given. Seven intact classes were used which met the following criteria: 1) a cross-section of upper-level health and physical education majors enrolled in 300-level to 500-level major courses (Group 3); 2) two 400-level and one 200-level home economics foods and nutrition courses (Group 2); and, 3) a general group was comprised of *non*-health/physical education majors who were enrolled in general education physical education classes. Differential group sizes are shown in Table 1.

Insert Table 1 about here

Instrument

The researcher-developed instrument contained 70 statements formed from authoritative literature. Each statement was answerable on a four-point Likert-type scale. Statements were categorized into sub-scales for ease in critiquing mastery status of the following select-topics: Nutrition Supplementation; Fluids and Hydration; Pre-Event Nutrition; Nutrition Composition; Nutrition Terminology; and, General Nutrition. A final section posed 17 Nutrition Opinion statements constructed to determine attitudes regarding various influences on sports nutrition and performance. A demographic sheet included select nutrition

education and information sources as well, on which subjects were asked to indicate sources from which they had gained nutrition knowledge.

The instrument was validated from an initial list of 154 preliminary knowledge statements, and 21 opinion statements. Instrument validation was performed by five professionals with expertise in the following fields: Nutrition, Sports Nutrition, Health Education, Testing/Evaluation, and Educational Research.

Procedure

The dependent variable was sports nutrition knowledge. A lone investigator administered the instrument during class-time, with standardized directions read to all participants prior to testing. The longest testing session took 35 minutes.

Data Analysis

Frequencies and percents were computed for all items on the instrument. Group mean differences were computed for each sub-scale and Total Score on the knowledge test and were compared by ONEWAY analysis of variance. The criterion for significance was set at $p < .05$. The reliability for the knowledge portion of the instrument revealed an alpha coefficient of 0.70.

Results

Demographics

This study focused on prospective and practicing physical educator/coaches, but two FNS students were found who aspired to coach as well. Of the 58 Group 3 (HPE) members, 44 indicated that they either planned to coach upon graduation, or were currently coaching in the schools in some capacity. No significant

differences were found on nutrition knowledge between the 36 male and 22 female HPE subjects.

Nutrition Supplementation

Mean scores for this sub-scale were the second lowest found for Groups 2 (FNS) and 3 (HPE), and the lowest scored by the GEN members. A difficult item for all groups concerned vitamin B-12 improving athletic performance. Over 70% of each group incorrectly responded to the statement. A positive response was that more than 70% of each group believed well-balanced diets could not be replaced by mineral/vitamin supplementation. Significant differences for all scale scores are illustrated in Table 2.

Insert Table 2 about here

Fluids and Hydration

No differences were confirmed between groups on this sub-scale. Two test items of note regarded protein consumption effects on exercise fatigue, and athletes weighing to monitor fluid losses. The former item was correctly marked by less than 40% of Groups 1 and 3 respectively. The latter statement was missed by greater than 70% of the subjects in each group. Two questions revealing positive replies for each group were that athletes need more daily water than non-athletes, and that electrolytes are important for maintaining delicate bodily fluid balances. Less than 11% of any one group missed the item on water

intake. In Groups 2 and 3, less than 20% of the subjects missed the electrolyte statement.

Pre-Event Nutrition

As shown in Table 2, the FNS and HPE members scored significantly higher than Group 1 in this section. Identical means for Groups 2 and 3 were at 70% mastery, the highest achieved by the HPE group, and the second highest obtained by the FNS students on any sub-test. The GEN students incorrectly answered three items with over 50% of the group responding inaccurately. One item on which all groups faired well concerned the inadequacy of hamburgers, fries, and softdrinks as a pre-event meal. More than 95% of Groups 2 and 3, and 90% of Group 1, were correct.

Nutrition Composition

This sub-scale tested knowledge on dietary carbohydrates, fats, and protein. Group 2 scored a mean significantly higher than the other groups. A notable item regarded athletes abstaining from red meats to promote good cardiovascular health. Sixty-five percent of Group 1 answered incorrectly, while 63.8% of the HPE group were incorrect.

Nutrition Terminology

Alarmingly, the HPE group scored significantly lower on this sub-test than any group. At least half of the group missed six of the 12 statements in that section. Three of the statements were incorrectly marked by more than 70% of the group. "Overhydration, Hyperhydration, Ergogenics, Multi-vitamins, Mega-vitamins", and "Amino Acids" are all terms with which human performance

personnel should be familiar, but the majority of the group did not indicate the proper definitions.

General Nutrition

The mastery score for this sub-scale by the FNS group was the highest earned by any group on the test (71%). Group 1 obtained 65% mastery for the section, and Group 3 attained the 67% mastery level. No significant differences were found between groups on this portion of the instrument. A statement producing 100% correct response from Groups 1 and 2 dealt with "fasting" as unsuitable weight-loss method. Eighty-one percent of Group 3 correctly responded. One statement producing a superior correct-answer rate from the HPE subjects concerned: the ability of cast-iron cookware to prepare foods yield higher nutritional value than foods cooked in other types of utensils. The remaining groups scored much lower on this item.

Total Knowledge Score

Because tests were scored according to least correct answers (1 point) through most correct (4 points), the lowest possible nutrition knowledge score for the test was 70 points, with the highest being 280 points. On a traditional scale these would respectively range from zero to 100. As indicated in Table 2, Group 2 achieved a significantly higher total mean score than the comparison groups.

Nutrition Education

In this study, sources most acknowledged by HPE students were high school courses. Conversely, FNS members seem to have received much of their education from college courses. The

information learned from college courses concentrating on nutrition appears to be more accurate than high school courses, as evidenced in the knowledge test scores. The subjects' nutrition information sources are shown in Tables 3 and 4. For this study 15 nutrition resources considered to be professional publications were pre-listed for subjects to indicate from which ones they had gained nutrition information. Bedgood and Tuck (1983) expressed concern over having not defined the term "professional journal" as a source in their study. That problem was rectified in this study.

Insert Table 3 about here

Insert Table 4 about here

Opinion Statements

Each opinionnaire item for the study is shown in Table 5, with corresponding affirmative response rates. There are many responses which affirm that not only is sports nutrition education needed for human performance professionals, but is desired, and should be required. One surprising statement response regarded steroids producing performance advantages for athletes. Group 3 members (48.2%) believed that anabolic and androgenic steroids do this. There remains skepticism among experts of these benefits, especially when considering side-effects resulting from (ab)use of such substances.

Insert Table 5 about here

Discussion

Nutrition Knowledge

The research questions for the study were answered as follows: 1a) Group 2 (FNS) scored a significantly higher mean on the nutrition knowledge test than Group 3 (HPE); 1b) Group 3 did not score significantly better than Group 1 (GEN) on the questionnaire; 2) There was no significant difference found between knowledge of males and females in Group 3; 3) The education and information sources relied upon by the HPE subjects appear to be unreliable in comparison with those of the FNS members; 4) Opinions of the HPE group did not seem as favorably disposed as those of the comparison groups; and, 5) The low 60% mastery-level mean earned by the HPE students demonstrates a non-passing grade by Bedgood and Tuck's standards (1983), not to mention the 80% criterion set for this investigation. A scrutiny of the findings on nutrition education sources confirms that HPE subjects could be better informed by more reliable means in regard to nutrition for human performance. Barely 25% of the HPE group marked any one professional publication as a resource they had utilized. Actually, some of the more reputable nutrition articles tend to appear in sources indicated by less than 10% of that group. In contrast, distinguished nutrition resources were indicated more frequently by the FNS subjects.

Results for the FNS members were not as high as anticipated, but it is possible that the addition of underclasspersons to that group attributed to such outcomes. A second issue which possibly caused lower scores for Group 2 is that a planned sports nutrition unit had not been taught to the upperclasspersons at the time of testing. This brings up two points. One, basic nutrition knowledge is applicable to specific sports nutrition. Two, the HPE members apparently do not rate well even when basic nutrition is considered.

Group 3 (HPE) was the attention-target for this inquiry; and as such, when compared to the findings of other similar studies, this group achieved a higher "Total Score". Coaches in a study conducted by Bedgood and Tuck (1983) scored a mean of 55.12. Physical education students in the Pujol and Godsey study (1990) earned a 57.65 mean on a similar test. Results of this study show a higher score for the aspirant physical educator/coaches. Typically, a longer test often is a more accurate indicator of knowledge, this study did not produce a "Total Score" much higher than other studies with a shorter instrument (Angel & Gillespie, 1990; Bedgood & Tuck, 1983).

HPE subjects who were intercollegiate athletes totalled 17, and 49 had been interscholastic athletes. In consideration of this fact, it is important to note the lack of sound knowledge on the part of many student-athletes.

Summary

Conclusions

Study findings indicate that sports nutrition knowledge of the HPE representatives tested is inferior to standard competency levels, whether 70% or 80% mastery, as well as compared to a semi-controlled group of FNS subjects. Significantly higher mean scores for the latter group substantiate this. It seems that education and information sources for HPE majors are presently insufficient. The disposition of the Group 3 members' opinions seems to be positive, and there are indications that they desire more improved education in this area.

Though the results of this study cannot be generalized to all coaches and/or physical educators, they are considered typical for persons who have not had proper instruction or self-development on the subject. Seemingly, collegians and their professiorate have not heeded suggestions for making sports nutrition education requisite in health and human performance curricula (Angel, 1988; Angel & Gillespie, 1990; Bedgood & Tuck, 1983; Cho & Fryer, 1974).

Implications

Interscholastic athletic coaches have little direct control over the dietary behaviors of student-athletes. The viable solution to this problem is for coaches to teach the youngsters under their tutelage, and parents, the proper nutrient entities and quantities necessary to fuel the active body in a quality fashion. Sport mentors must have factual advice to extend. It is their duty as a responsible specialist to maintain current and

reasonable expertise on which to base guidance, for numerous studies have indicated that secondary and collegiate student-athletes lack that knowledge independent of sound instruction (e.g. Douglas & Douglas, 1984; Perron & Endres, 1985; Shoaf, McClellan, & Birskovich, 1986; Short & Short, 1983; Steen & McKinney, 1986; Welch, Zager, Endres, & Poon, 1987). The present study to a certain extent is a testimony to this as well.

Stress and strain in the literal "heat of battle" can degenerate the body. Why lose an event by overlooking a vital aspect of athletic preparation? Why take a chance on not having the infamous "winning edge" for which athletes and coaches strive? Why permit athletes to "run out of gas" in the waning moments of competition, and possibly risk injury for that reason, simply because they did not own the wisdom to be properly fueled? These questions are posed not to rebuke, but to provoke interest in components of human performance which may be neglected on the part of many coaches. These elements reach beyond the requisite skills and strategies, and call for professional improvement. One should be able to discern fallacious information from that which is factual. The sports nutrition field is saturated with fresh research that can benefit athletes. Coaches would benefit greatly from improved education on this component of athletic training.

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Appendix A

Glossary of Terminology

Amino Acids: The chief components of proteins which are synthesized by living cells or obtained as essential dietary items.

Anabolics: Synthetic hormones which constructively aid metabolism concerned with macromolecular synthesis.

Androgenics: Male sex hormones produced naturally in humans.

Biochemistry: Internal human chemistry dealing with chemical compounds and processes of the body.

Bioenergetics: The biology of energy transformations and exchanges within humans.

Bioenergy: Energy available to the body for work output.

Dehydration: Abnormal depletion of body fluids.

Electrolytes: Minerals that help maintain delicate fluid balances within the human body.

Ergogenics: Aids or procedures acting by mechanical, psychological, nutritional, pharmocological, or physiological means and believed to improve mental and/or physical performance.

Hyperhydration: Ingestion of extra water before heavy exercise.

Mega-Vitamin(s): A Pack(et) of vitamins taken daily containing up to more than 10 times the RDA for all vitamins and minerals.

Multi-Vitamin: A substance containing several vitamins and minerals known to be essential to health and growth.

Overhydration: Forcing fluid replacement daily during hot weather and/or heavy training.

Rehydration: Restoration of body fluids lost through exercise.

Sport(s) Nutrition: A specialized sphere of nutrition related to how athletes utilize food, fluids, and nourishing substances.

Appendix B

Table 1
Subjects by Academic Status

Level	Group 1 (GEN) N	Group 2 (FNS) N	Group 3 (HPE) N
Freshman	1	2	2
Sophomore	5	6	5
Junior	5	8	24
Senior	8	11	19
Graduate	1	--	8
Total	20	27	58

Table 2

Summary of Scores and Significant Findings

Test Variable	Group	Mean Score	% Mastery	F-ratio	F-prob.
Nutrition Supplementation	1	34.7000	49.0	9.2920	.0002
	2*	40.0000	62.0		
	3	36.0345	53.0		
Fluids and Hydration	1	33.1500	59.0	2.1920	.1170
	2	35.3333	65.0		
	3	34.4138	62.0		
Pre-Event Nutrition	1	28.4500	62.0	4.0775	.0198
	2*	31.0370	70.0		
	3*	30.9655	70.0		
Nutrition Composition	1	31.8500	55.0	5.6273	.0048
	2*	35.2593	65.0		
	3	32.9828	58.0		
Nutrition Terminology	1	32.4500	57.0	3.6454	.0296
	2*	33.0741	59.0		
	3	30.7069	52.0		
General Nutrition	1	29.4000	65.0	1.0337	.3594
	2	31.2222	71.0		
	3	30.1379	67.0		
Total Score	1	191.5500	58.0	6.3941	.0024
	2*	205.9259	65.0		
	3	195.0690	60.0		

* Significant at $p < .05$ level

Direction of Significant Difference

Nutrition Supplementation	FNS > HPE & GEN
Pre-Event Nutrition	FNS & HPE > GEN
Nutrition Composition	FNS > HPE & GEN
Nutrition Terminology	FNS > HPE
Total Score	FNS > HPE & GEN

Table 3

Percent of Subjects Indicating Sources Providing them Nutrition Education

Source	GEN %	FNS %	HPE %
High School Health Course(s)	60.0	66.7	86.4
High School Physical Education Course(s)	55.0	53.3	81.4
High School Home Economics Course(s)	55.0	46.7	57.6
Specific College Nutrition Course(s)	10.0	86.7	18.6
Nutrition not part of any College Course	10.0	06.7	15.3
Nutrition part of Various College Courses	25.0	30.5	45.8
Physician/Nurse	20.0	23.3	23.7
Newspapers/Magazines	55.0	76.7	52.5
Radio/Television	40.0	56.7	52.5
Nutritionist/Dietician	10.0	40.0	15.3

Table 4

Percent of Subjects Perusing Professional Journals Containing Nutrition Information

Journal	GEN %	FNS %	HPE %
Tufts University News Letter	05.0	06.7	03.4
Nutrition News	----	10.0	01.7
Nutrition Today	----	10.0	01.7
JOPERD	----	----	18.6
JAMA	15.0	10.0	10.2
The Physician And Sports Medicine	05.0	10.0	25.4
Sports Medicine	----	06.7	15.3
American Journal of Sports Medicine	----	03.3	20.3
Sport Care & Fitness	----	----	06.8
Medicine and Science in Sports and Exercise	----	03.3	10.2
The Physical Educator	----	----	11.9
RQES	----	03.3	15.3
JTPE	----	----	05.1
Journal of The American Dietetic Association	10.0	30.0	01.7
Journal of Clinical Nutrition	----	13.3	01.7

Table 5

Subjects' Opinions Indicated by Affirmative Response

Statement	GEN %	FNS %	HPE %
I have sufficient knowledge of nutrition.	15.0	44.4	38.6
Athletic performance is directly affected by dietary habits.	75.0	85.2	80.7
Coaches are influential in guiding athletes' dietary habits.	80.0	88.9	82.5
Athletic coaches should counsel athletes on nutrition.	95.0	96.3	82.5
A nutrition course for aspiring coaches should be required.	90.0	100.	87.7
A nutrition course for practicing coaches should be required.	95.0	100.	86.0
A specific course directed at fitness or sport enthusiasts would be beneficial for high school students.	85.0	88.9	90.7
Home economics teachers should be responsible for teaching nutrition to athletes.	45.0	44.4	52.7
Physical educators/coaches should be responsible for teaching nutrition to athletes.	85.0	85.1	81.5
Health educators should be responsible for teaching nutrition to athletes.	80.0	74.0	85.2
Nutrition education for athletes should be left to parents and personal decision-making.	20.0	07.4	33.9
Sport(s) nutrition and its associated biochemistry is an overlooked and underrated aspect of performance.	75.0	74.0	83.9
Anabolic and androgenic steroids produce a performance advantage for competitive athletes.	40.0	25.9	48.2
Smokeless tobacco use by high school athletes is acceptable.	0.0	03.7	14.3
Smokeless tobacco use by coaches is acceptable.	0.0	0.0	10.8
Smoking by athletic coaches is acceptable.	0.0	03.7	16.1
Athletic coaches should exhibit positive nutrition attitudes and habits.	90.0	100.	82.1

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